

10 mode are at least several times larger in both the transverse and lateral directions than the  
11 optical wavelength inside the dielectric medium of the waveguide.

1 57. The device of claim 56 further comprising second and third heightened regions, which  
2 extend parallel to and are separated from said first heightened region along the longitudinal  
3 axis, and include absorptive regions to provide loss for higher order spatial modes.

1 58. The device of claim 56, wherein loss in said first and second lateral regions is generated  
2 by bombardment of all or certain layers with protons or other damage-inducing ions to provide  
3 additional loss for higher order spatial modes.

1 59. The device of claim 56, wherein loss in said first and second lateral regions is generated  
2 by roughening the sidewalls of the device to further suppress higher order spatial modes.

1 60. The device of claim 56, wherein loss in said first and second lateral regions is generated  
2 by doping said regions to provide large free-carrier absorption which adds additional loss for  
3 higher order spatial modes.

1 61. The device of claim 56, wherein the cross-sectional dimensions of the lowest order spatial  
2 mode are at least an order of magnitude larger than the optical wavelength inside the dielectric  
3 medium of the waveguide.

1 62. The device of claim 57, wherein the cross-sectional dimensions of the lowest order spatial  
2 mode are at least an order of magnitude larger than the optical wavelength inside the dielectric  
3 medium of the waveguide.

1 63. The device of claim 56, wherein the contours of constant optical intensity for the lowest  
2 order spatial mode supported within said waveguide are nearly circular.

1 64. The device of claim 56, wherein the contours of constant optical intensity for the lowest  
2 order spatial mode supported within said waveguide have an approximately elliptical shape  
3 with a small aspect ratio.

1 65. The device of claim 57, wherein the contours of constant optical intensity for the lowest  
2 order spatial mode supported within said waveguide are nearly circular.

1 66. The device of claim 57, wherein the contours of constant optical intensity for the lowest  
2 order spatial mode supported within said waveguide have an approximately elliptical shape  
3 with a small aspect ratio.

1 67. The device of claim 57, wherein the first heightened region in the waveguide is defined by  
2 a region between two parallel etched channels in said layers, and wherein said second and third  
3 heightened regions are positioned outside the two parallel etched channels.

1 68. The device of claim 56, wherein a quantum well region provides gain.

1 69. The device of claim 56, wherein a quantum well region comprising one or more quantum  
2 wells, barrier layers and bounding layers provides gain.

1 70. The device of claim 56, wherein a strained-layer quantum well region provides gain.

1 71. The device of claim 56, wherein a strained-layer quantum well region comprising one or  
2 more quantum wells, barrier layers and bounding layers provides gain.

1 72. The device of claim 56, wherein a region containing quantum dots or quantum wires  
2 provides gain.

1 73. The device of claim 56 in which a region containing quantum dots or quantum wires  
2 inside one or more quantum well layers provides gain.

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1 74. The device of claim 56, wherein gain is provided by a region containing one or more  
2 semiconductor layers.

1 75. The device of claim 57, wherein the regions between the first and second heightened  
2 regions and between the first and third heightened regions are filled with high resistivity  
3 material.

1 76. The device of claim 56, wherein said waveguide is comprised of a plurality of layers of  
2 semiconductor material with different optical indices.

1 77. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made of III-V compound semiconductors.

1 78. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in the  $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}$  semiconductor system on an InP  
3 substrate.

1 79. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}$  semiconductor system on an InP  
3 substrate.

1 80. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in a combination of the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}$  and  $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}$   
3 semiconductor systems on an InP substrate.

1 81. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in the  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  semiconductor system on a GaAs substrate.

1 82. The device of claim 76, wherein said plurality of layers of semiconductor material with

different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}$  semiconductor system on a GaAs substrate.

83. The device of claim 76, wherein said plurality of layers of semiconductor material with different optical indices are made in a combination of the  $\text{Al}_x\text{Ga}_{1-x}\text{As}_z$  and  $\text{In}_x\text{Ga}_{1-x}\text{As}$  semiconductor systems on a GaAs substrate.

84. The device of claim 76, wherein said plurality of layers of semiconductor material with different optical indices are made in a the  $\text{Ga}_y\text{In}_{1-y}\text{As}_z\text{P}_{1-z}$  semiconductor systems on a GaAs substrate.

85. The device of claim 76, wherein said plurality of layers of semiconductor material with different optical indices are made in a the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}_z\text{P}_{1-z}$  semiconductor systems on a GaAs substrate.

86. The device of claim 76, wherein said plurality of layers of semiconductor material with different optical indices are made in a combination of the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}_z\text{P}_{1-z}$  and  $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}$  semiconductor systems on a GaAs substrate.

87. The device of claim 76, wherein said plurality of layers of semiconductor material with different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}_z\text{Sb}_{1-z}$  semiconductor system on an InP substrate.

88. The device of claim 76, wherein said plurality of layers of semiconductor material with different optical indices are made in a combination of the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}_z\text{Sb}_{1-z}$  and  $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}$  semiconductor systems on an InP substrate.

89. The device of claim 76, wherein said plurality of layers of semiconductor material with different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}_z\text{Sb}_{1-z}$  semiconductor system on a GaSb

3 substrate.

1 90. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}_z\text{Sb}_{1-z}$  semiconductor system on an InAs  
3 substrate.

1 91. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  semiconductor system on a GaN  
3 substrate.

1 92. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  semiconductor system on a sapphire  
3 substrate.

1 93. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  semiconductor system on a SiC  
3 substrate.

1 94. The device of claim 76, wherein said plurality of layers of semiconductor material with  
2 different optical indices are made in a the  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{As}_z\text{N}_{1-z}$  semiconductor systems on a  
3 GaAs substrate.

1 95. The device of claim 76 wherein said plurality of layers of semiconductor material with  
2 different optical indices are made of II-VI compound semiconductors.

1 96. The device of claim 76 wherein said plurality of layers of semiconductor material with  
2 different optical indices are made of IV-VI compound semiconductors.